greedily eaten by horses, and produces great nervous and muscular disorder, in most cases resulting in death.——J. C. Arthur's Contributions to the flora of Iowa, VI, in the Proc. Davenport Acad. Nat. Sci., Vol. IV, adds twenty-four phanerogams to the previous lists, and now for the first time enumerates the pteridophytes, thirty-four in number. Of the latter twenty-three are ferns.——The Journal of the Linnean Society for August contains a curious plate representing pollen cells and an anther of a poppy (*Papaver rhœas*) from a funeral garland from the coffin of an Egyptian princess of the twenty-first dynasty, that is about 1000 B.C. Both pollen-cells and anthers appear to be slightly larger than those of recent plants, but otherwise the resemblance is very close.——H. N. Patterson, of Oquawka, Ill., has issued a neat Check-list of North American Gamopetalæ made to agree with Gray's Synoptical Flora. It will be a convenience in the herbarium.——J. C. Arthur has observed a distinct polarity in the leaves of garden lettuce, according to a note in the *Botanical Gazette*.——Dr. F. Hauck's *Meeresalgen*, being the second volume of the new edition of Rabenhorst's Kryptogamen Flora, has reached part VIII, which contains the Phæozoösporeæ, Oösporeæ and Chlorozoösporeæ.——Luerssen's *Farnpflanzen* (Vol. III of Rabenhorst) has reached part III, devoted to a continuation of the Polypodiaceæ. The illustrations in both the foregoing are most excellent.

ENTOMOLOGY.

MODE OF OVIPOSITION OF THE COMMON LONGICORN PINE BORER (*Monohammus confusor*).—The exact mode of deposition of their eggs by the longicorn beetles is not well known, so far as we are aware. We have been fortunate enough to observe the female beetle while at work making the incision with her jaws, though we have not observed the act itself of deposition of the eggs. While examining the fir trees on the western shores of Birch island, Casco bay, Maine, on a warm sunny afternoon of August 30th, I saw a male *Monohammus confusor* standing on the bark of a living fir about nine inches in diameter, within the distance of less than two inches from a female, whose jaws were buried in the bark of the tree on the western side of the trunk which was exposed to the full rays of the sun.

On beginning to make the incision each of the large sharp strong jaws of this beetle are pushed directly into the bark; they are then apparently brought together, and the result is a slight curvilinear gash which descends obliquely in the bark. It is probable that the beetle pries up the pad thus formed, so that the freshly cut edges are exposed, and an opening is thus formed into which the egg is thrust. While watching the female at work the male dropped to the ground, and his consort, becoming alarmed, withdrew her jaws from the incomplete incision, when I seized

her. To the end of her abdomen were attached a few fragments of the reddish inner bark of the fir, and two or three small green pellets, probably excrement; but this showed that she had already deposited at least one egg, and that the labor of oviposition was slight, the end of the abdomen probably being simply extended and thrust into the gape of the incision.

By prying up the pad formed by the jaws, a shallow but roomy cell or chamber is made for the egg, which lies nearly or quite horizontally, not vertically, to the trunk of the tree.

The egg is very large, ovo-cylindrical, well rounded but tapering somewhat at each end, of a dirty white color, and in length is $4\frac{1}{2}^{mm}$.

On visiting the tree a week later and removing a portion of the bark and examining it Sept. 6–8, the eggs had in some cases hatched and the larvæ had begun to descend slightly into the bark. On hatching they begin at once to gnaw a mine, throwing their castings out through the gash originally made by the female, so that it was easy to ascertain, without disturbing the bark, whether the eggs had hatched or not. The larva indifferently lies with either side, dorsal or ventral, presented outwards. Three days after (Sept. 12) several had bored through the pieces of bark making the usual flattened oval hole, but probably in nature the larva remains hidden in the bark through the winter, not beginning to penetrate the wood until the following spring.

The length of the larva when freshly hatched was $5–6^{mm}$, and the body was rather stouter than in the full-grown larva.

How many eggs are laid by the female is not known, but probably, judging by their large size, comparatively few.

Another female was found on the same tree. Over a hundred gashes had been made on the western side of this fir tree over a space four feet long. The gashes were so fresh that they must have been made on that and a few previous days. They were quite conspicuous and could, after one had become familiar with their appearance, be detected at the distance of at least five or six feet from the tree. I suspect that the sexes couple frequently during the operation of egg laying, as the male was standing so near his mate with his antennæ outstretched and intently watching the female while at work. The males are also probably polygamous.

The industry of the females is well shown by the number of the gashes made, some of which did not however contain any eggs. In the space of a square inch there were three gashes, while in the region where they were thickest, forty were counted in half a square foot. Of course when they hatch all do not live to pass through their transformations. Whether the woodpecker seeks for and discovers the larvæ while encased in the bark is doubtful, and yet it would be easy for these or other birds to pick the grub out of their hiding places. So far as my observations have

gone, the holes made by the woodpecker in forest trees are for the purpose of getting at the inner bark rather than for insects. But a careful examination in September of woodpeckers shot in coniferous forests would throw light on this subject.

In regions where the white pine grows, it is infested by this Monohammus. The spruce is also often infested, but I have not seen clear cases where either of those trees have been killed outright by this destructive borer. But during the past summer I have seen on the islands in Casco bay, and taken out the full-grown larvæ from at least six or seven living firs, which must have been killed by the attacks of this borer, which has been the evident cause of the death of many firs in Maine. I have also been told by lumbermen that fir trees are killed by this borer. Near Rangely, Maine, an extensive tract of firs was killed outright, I was informed, by "the borer," undoubtedly this beetle.

I have seen hundreds, perhaps nearly a thousand, dead firs whose trunks were riddled with the holes of these borers. The spruce is less frequently killed, but I have taken from a dead tree two pieces of spruce bark, each about six inches square, one containing sixteen and the other eighteen holes, through which the beetle had escaped.—*A. S. Packard.*

Egg-laying Habits of the Maple-tree Borer.—Fresh from the foregoing observations I looked, Sept. 12th, for the eggs or freshly hatched larvæ of *Glycobius speciosus*, and found the latter at once. The Rev. Mr. Leonard, of Dublin, N. H., many years ago, in a letter to Dr. Harris, stated that the maple-tree borer, on hatching, remained in the bark through the winter. Upon examining a rock maple about two feet in diameter, it was found that twenty eggs had been laid in different parts of the bark from near the ground to where the branches originated, a distance of about ten feet. The site of oviposition was recognized by a rusty irregular discoloration of the bark about the size of a cent, and especially by the "frass" or castings which to the length of an inch or more were attached like a broken corkscrew to the bark. On cutting into the bark the recently hatched larvæ 5–7 ^{mm} in length, were found lying in their mine or burrow at the depth of from a tenth to the sixth of an inch.

The burrows already made were about an inch long, some a little longer; the larva usually mines upward. No eggs were found, but they are laid in obscurely marked gashes about a fifth of an inch long, usually near a crevice in the bark. These gashes and castings are readily discoverable, and it would be easy to save these valuable shade trees by looking for them in the autumn and winter or early spring, and cutting them out. The beetles were not uncommon at Brunswick in July and August of the past year.

Of six grubs which I cut out one half seemed unhealthy, perhaps diseased by the water which had penetrated their mine.

I have recommended protecting valuable shade trees by wrapping the trunks with bands of cloth well saturated with kerosene oil, in August and September, so as to drive off the beetle, and to destroy the freshly hatched grub, but since discovering how easily the gashes and castings of the freshly hatched worms can be detected a few days or weeks after the eggs have been laid, it seems obvious that the easiest and surest preventive is to cut out the grubs when laying in their autumn and winter quarters just under the surface of the bark.

It is almost impossible to destroy the fully grown worms in their "mines" or burrows, since the latter extend up the tree either directly under the bark or sunken in the wood. On one tree, nearly destroyed by this borer, out of about fourteen mines, twelve extended upward. Hence it is useless to try to find the hole and inject oil into it. There now seems no reason why valuable shade maple trees should not be saved by an hour's close observation and removal of the young grubs, say in September or October.—*A. S. Packard.*

PALMEN'S PAIRED OUTLETS OF THE SEXUAL ORGANS OF INSECTS.[1]—In an investigation of this kind it is natural that the anatomist should seek the most primitive condition of almost any organ in insects, in that primitive generalized group, the Pseudoneuroptera and especially the Ephemerina. The double nature of the oviducts and male outlets in this group had been slightly indicated by Swammerdam and Burmeister, but Palmén in this elaborate and learned essay has thrown much new light on the subject and reaches some most interesting conclusions. The work is divided into five chapters, the first being introductory and being a history of entomotomy. In the second chapter the opinions of the earlier authors on the sexual organs of the Ephemerina are given, and in the third chapter the author's own very complete observations are recorded, while in the fifth chapter the ovaries and oviducts of other insects, principally certain Pseudoneuroptera, Orthoptera and Neuroptera, are described. The drawings and microscopic sections are well rendered, and on plate v are given useful diagrammatic figures illustrating the morphology of the ovaries and oviducts of selected types of the lower orders of insects as compared with the ovaries and segmental organs of the worms and Crustacea.

Professor Palmén's conclusions, drawn from his studies on the Ephemeridæ, are as follows:

1. The genital ducts are in both sexes throughout their whole extent independent of each other and also paired. Their terminal sections become united only by the integument itself under

[1] Ueber paarige Ausführungsgänge der Geschlechtorgane bei Insecten. Eine morphologische untersuchung. V on J. A. Palmén. Mit 5 tafeln. Helsingsfors, 1884. 8vo, pp. 108.

them; in the males the two ducts open out in the partly formed outgrowths of the integument forming the two penes; in the females they are united by means of a transverse ingrowth of the integument, the genital intersegmental fold.

2. The entire apparatus consists also of two heterogeneous components: internal parts which are developed from the genital germs of the embryo, and are simply cellular, and external, tegumental parts (the chitinous cuticula) which slough off during growth.

These two components arise from two different sources: the internal are differentiations of the embryonic epithelium of the body cavity; the external, like the integument generally, originate directly from the epiblast of the embryo.

3. In the terminal section of the passages leading outward (ductus ejaculatorius and the oviduct) no chitinous cuticula has been observed.

4. The male ducts open behind the ninth, the female behind the seventh abdominal segment.

5. In the passages leading out, the principle of division of labor is only partially carried out. Accordingly the corresponding sections of the ducts differ little from each other morphologically, and differentiations in the shape of peculiar forms of appendages are, as a rule, not present.

As regards the fourth point the Ephemerina differ from other insects (in which it opens behind the eighth) in having the oviduct open behind the seventh abdominal segment. This indicates, Palmén thinks, a high phyletic age for this group.

Graber's statement that the sexual passages in the pupa of Chironomus are paired, is referred to, and Palmén adds that this is the case with Corethra and other dipterous pupæ. Finally it appears that anatomical and embryological modes of investigation have brought about similar results.

THE NATURE OF THE SO-CALLED "LIVER" IN THE ARACHNIDS. —We have received from Dr. Bertkau his final essay on this interesting subject, and translate his conclusions. The original appears in the Archiv für mikroskopischer Anatomie, band 23, 1884.

The "liver" of spiders so develops that the enlarged part of the digestive tract in the base of the abdomen forms a considerable number of smaller and larger outgrowths, which branch out more and more, and through an intermediary tissue becomes united into an anatomical unity.

Among the outgrowths of the digestive tract are five of considerable extent; one is situated in front on the under side of the intestinal tract; the rest are arranged in pairs behind on the upper side; the hindermost pair are at first narrow and have in their walls muscular fibers (?). The outgrowths, like the part of the digestive tract, where they arise are of a glandular nature.

Among the epithelial cells are to be distinguished two kinds, smaller oval cells filled densely with large colorless nuclei, and larger club-shaped ones whose contents, among other things, consist of small crystals and larger drops of yellow, brown, green colors.

The principal effect of the secretion of these glandular cells is the solution and digestion of fibrin, digested protoplasm, etc.

The spiders take no solid nourishment. They dissolve the assimilable, solid constituents of their prey, muscles, etc., and they suck the flowing blood. This passes into the ultimate branches of the intestinal outgrowths. The hind gut or terminal section of the digestive canal begins immediately behind the last pair of the intestinal outgrowths or diverticula.

The malphigian vessels are dispersed through the intermediate tissue. Their excretions are guanin or an allied substance. The same or an allied substance is found in many kinds, both deposited in the external layer of the intermediate tissue and distributed prominently in the coloring and markings of animals.

In the present condition of our knowledge it is fitting to supply the name "liver" in the Arachnida by "chyle-stomach."

We do not feel entirely satisfied with the last main conclusion. The same mode of reasoning might be applied to the vertebrate liver, which is composed of diverticula of the chyle-stomach. There seems to us no good reason for not, as a matter of convenience, applying the term "liver" to the enormous glandular outgrowths of the Arachnidan chyle-stomach. To confound the "liver" of a spider with its source, the chyle-stomach, is not, we would suggest, good morphology. Moreover, embryology shows that the diverticula are secondary outgrowths from the mid-gut of the embryo, which becomes finally the chyle-stomach of the adult animal.—*A. S. P.*

THE SYSTEMATIC POSITION OF THE EMBIIDÆ.—It will be remembered that this singular group of insects is usually placed next below the white ants (Termitidæ). Mr. J. Wood-Mason has added to our knowledge of these insects, and concludes as follows regarding their affinities: "In anticipation of the full and detailed account of the numerous and important differences between them and the Perlidæ which is in preparation, and will be published as soon as the drawings needed to render my descriptions intelligible are ready, I may say that the Embiidæ undoubtedly belong to the true Orthoptera, that they are in my opinion in some respects the lowest term, and in others the lowest term but one, of a series formed by the families Acridioidea, Locustidæ, Gryllidæ and Phasmatidæ, and that their resemblances to the much lower Perlidæ, which may well be direct descendants of a form closely related to Campodea, are due to their low position in the division of Orthopterous insects to which they belong, and

do not imply any such close genetic relationship to them as has been suggested" (Proc. Zool. Soc. London, 1884).

Mr. Mason has detected the females, before unknown, which are wingless and of larger size than the males. He also discovered in India larvæ of a species apparently living in society.

ENTOMOLOGICAL NOTES.—A case of sexual attraction in Prionus is noticed by Anna K. Dimmock in *Psyche* for April. A female about to oviposit was caged, when one male after another flew to the cage, so that a great many males were taken in the afternoon. "On account of the presence of so many males a number of females made their appearance, showing an attraction of the female to the male, like that above noted of males attracted by females." Apropos of this fact, Mr. F. Clarkson states in the *Canadian Entomologist* for May, that the presence of *Prionus brevicornis* is quickly realized by the odor of the female, which is very powerful and can readily be detected twenty feet distant. "I placed a female immediately after emergence in an uncovered jar, and wherever I positioned it, on the piazza or elsewhere, the males were attracted from every direction. I captured twenty males in a very few minutes."——Mr. W. H. Edwards contributes to the *Canadian Entomologist* for May, useful directions for breeding butterflies from the egg.——M. Jules Künckel has communicated to the Paris Academy of Science, as the result of his researches upon the movements of the heart in insects during their metamorphosis, the statement that this organ continues to beat during the phenomena of histogenesis. In *Volucella zonasia* and *Eristalis æneus* it was observed that when movement was lost, on the twelfth day in the first species and the ninth in the second, the two great wing muscles were already developed, and the eyes were evident upon dissection. The short period of quiescence of the heart is occupied in the histological changes of that organ, above all in the formation of an aortic region corresponding to the formation of the thorax.——The researches of M. Carlet have brought to light a previously unknown part of the sting of the honey-making Hymenoptera. The poison-bag of these insects is destitute of a muscular wall, and is thus incapable of emptying itself, but the stylets of the sting are furnished at their base with a veritable piston which moves within the length of the base of the sting, and whether the stylets move simultaneously or alternately, at each movement forces a drop of venom into the wound and produces a new afflux of liquid at the base of the sting, which is thus at once an aspirator and an injector.

ZOÖLOGY.

NEW CLASSIFICATION OF THE ROTIFERS.—Dr. C. T. Hudson, in the *Quarterly Journal of Microscopical Science* for July, attempts a re-classification of the rotifers. His paper, which is illustrated